DWH NRDA: Summary of Injuries to the Public’s Natural Resources

Tom Brosnan et al., NOAA OR&R, RAE Conference 12/15/16
Oil Pollution Act; 15 CFR 990

Who: Trustees

Responsibilities:

- Determine amount of injury to natural resources and lost services from time of incident through recovery of resources
- Develop and oversee implementation of restoration plan(s) to compensate the public for injuries and lost services
- Ensure the polluters pay for assessment and restoration
Assess injuries to natural resources
Ensure restoration of injured natural resources and lost uses

### Federal Trustee Agencies
- **Department of the Interior**
  - U.S. Fish and Wildlife Service
  - Bureau of Land Management
  - National Park Service
- **Department of Commerce**
  - National Oceanic and Atmospheric Administration
- **Environmental Protection Agency**
- **Department of Agriculture**

### State Trustee Agencies
- **Florida**
  - Department of Environmental Protection
  - Fish and Wildlife Conservation Commission
- **Alabama**
  - Department of Conservation and Natural Resources
  - Geological Survey of Alabama
- **Mississippi**
  - Department of Environmental Quality
- **Louisiana**
  - Coastal Protection and Restoration Authority
  - Oil Spill Coordinator’s Office
  - Department of Environmental Quality
  - Department of Wildlife and Fisheries
  - Department of Natural Resources
- **Texas**
  - Commission on Environmental Quality
  - General Land Office
  - Parks and Wildlife Department
Unique Challenges of DWH Response and Assessment:

- Release ~1 mi. deep, -50 mi. offshore
- 86 days, ~134M gal. released
- Use of dispersants -1.84M gal.
- Diverse resources, life stages and habitats, in 3D space
- High human use and value – commercial and recreational
- 5 States, multiple agencies, volunteers, press, pressure, etc.
- Cooperation with responsible party
- Limited baseline information
Largest Oil Spills Affecting U.S. Waters
1969 - Present

Even relatively small oil spills can cause major harm, depending on location, season, environmental sensitivity, and type of oil. This was the case for the following spills:
- M/V Selendang Ayu - 2004 - AK
- M/T Athos I - 2004 - NJ/PA
- M/V Cosco Busan - 2007 - CA
- M/V New Carissa - 1999 - OR

Hawaiian Patriot - 1977

Deepwater Horizon - 2010
- Epic Colocotronis - 1975
- Vista Bella - 1991
- Hurricane Hugo - 1989
- Santa Augusta - 1971
- Peck Slip - 1978
- Morris J. Berman - 1994

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Data Collection Efforts

- 20,000 trips to the field to collect data
- 100,000 environmental samples collected
- 13 million records publically available
- Sediment, air, water, tissue samples, carcasses, photos and videos, telemetry, aerial imagery, GPS data, observations

[Map of Louisiana with color-coded zones]

dwhdiver.noaa.gov
The Trustees documented an ecosystem-level of injury to the northern Gulf of Mexico.

The Trustees proposed an ecosystem-level, integrated restoration plan.

Restoration plan to be funded by up to $8.8 billion over 15 years in the NRDA settlement.
How did we arrive at an ecosystem level injury?

-high-level highlights from the NRDA injury assessment
Development of Conceptual Models

Overview of Deepwater Horizon Contamination Exposures

- Offshore Exposure
  - Wind and current
  - Dispersants

- Nearshore Exposure
  - Wind and waves

- Water Column Exposure
  - Marine snow
  - Deep plume

- Air Exposure
  - Wellhead

- Benthic Exposure

- Sediment mixing

- Mixing zone
134 million gallons (3.19 million barrels) oil released into the Gulf of Mexico
1.84 million gallons chemical dispersant used
> 43,300 square miles cumulative footprint of surface oil slick
~400-700 square miles of deep sea floor oiled
15 trillion gallons of water contaminated daily under the surface slick
1,300 miles of shoreline oiled
Indicators of Ecosystem Level Injury

- Marshes Injured
  - Plant cover and vegetation mass reduced along ~350-720 miles of shoreline
  - Amphipods, periwinkles, shrimp, forage fish, red drum, fiddler crabs, insects killed

- Harvestable oysters lost
  - ~4-8.3 billion harvestable oysters lost

- Birds, fish, shellfish, sea turtles, and dolphins killed
  - 51,000 - 84,000 birds killed
  - ~56,000-166,000 small juvenile sea turtles killed
  - Up to 51% decrease in Barataria Bay dolphin population
  - ~2-5 trillion newly hatched fish were killed

- Rare corals and red crabs impacted
  - 400 - > 770 square miles around the wellhead

- Recreational opportunities lost
  - ~$527-$859 million in lost recreation such as boating, fishing, beach-going
up to $8.8B for Natural Resource Damages
- Includes $1B for Early Restoration (partially paid)
- Includes up to $700M to address future unknown conditions

$5.5B for Clean Water Act civil penalties
- $4.4B (80%) will flow through the RESTORE Act
- $1.1B (20%) will go to the Oil Spill Liability Trust Fund

$5.9B for economic claims
- $4.9B to the 5 Gulf states
- Up to $1B to local governments in the 5 Gulf states

$0.6B for additional payments
- $0.35B NRD assessment costs
- $0.25B False claims act royalties on oil; response & other costs
NRDA Settlement

- NRDA payments must be used to restore or replace nature resources lost or injured by the spill – restoration projects

- Payments include:
  - Unknown conditions and adaptive management – up to $700 million
  - Costs of assessment

- Will be paid out over 15 years (starting one year after CD is final)

- Restoration outlined in PDARP/PEIS
Preferred alternative represents an ecosystem approach to restoration

Coastal habitat restoration is integral to restoring for many injuries

Additional restoration needed to fully restore all resources, habitats, and recreational use losses

Foundational: science-based adaptive management

This PDARP sets the framework for future decision-making, including selection & implementation of projects
More information and data:

PDARP/PEIS: www.gulfspillrestoration.noaa.gov

DIVER: dwhddiver.noaa.gov

OR&R Publications and Resources: response.restoration.noaa.gov

ERMA: http://gomex.erca.noaa.gov
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Questions?
EXTRA SLIDES IF NEEDED
Our plan identifies 5 goals (purple) and invests in 13 restoration types (blue):
Deepwater Horizon Gulf Science and Restoration Initiatives

Civil Penalties
- Transocean ($1 billion)
- BP ($5.5b)
  - RESTORE Act 80%
    - 35% Direct Component
    - 30% Council Component
    - 30% Spill Impact Component
    - 2.5% Centers of Excellence
    - 2.5% NOAA Science Program

Criminal Penalties
- BP ($2.84 billion)
  - North American Wetlands Conservation Fund ($100m)
- Transocean ($300 million)
  - National Fish and Wildlife Foundation ($2.54b)
  - National Academy of Sciences ($500m)

Natural Resource Damages
- Responsible Parties- BP, etc.
  - NRDA Trustee Council
    - BP Early Restoration ($1b)
    - Nat. Res. Damages ($7.1b)

Others
- Gulf of Mexico Research Initiative ($500 million)
30+ peer reviewed publications and counting......

- Deepsea corals and benthos
- Dolphins
- Fish Toxicity
- Sea Turtles
- Oil in the environment

~40 DWH NRDA presentations at GoMRI 2016

Publications available to public:
Long Term Data Incorporation and Management in Draft Consent Decree

- NOAA to establish, populate, manage, and maintain a Gulf-wide environmental data management system
- Accessible to all Trustees and the public (10 years)
- DIVER as platform
- Restoration data repository and central reporting platform
- Support comprehensive data sharing for ecological effects and restoration
- Provide scientific foundation and baseline information for future science
BPXP is to pay the United States a civil penalty of $5.5 billion under the Clean Water Act (CWA) – payable over 15 years.

BPXP will pay $7.1 billion to the United States and the five Gulf states over 15 years for natural resource damages (NRD). This is in addition to the $1 billion already committed for early restoration. BPXP will also set aside an additional amount of $232 million to be added to the NRD interest payment at the end of the payment period to cover any further natural resource damages that are unknown at the time of the agreement.

A total of $4.9 billion will be paid over 18 years to settle economic and other claims made by the five Gulf Coast states.

Up to $1 billion will be paid to resolve claims made by more than 400 local government entities.
Response Actions
Mortality determined for early life stage fish and invertebrates in surface slick, subsurface mixing zone, rising cone, deep plume.

The volume of contaminated water in subsurface mixing zone quantified using empirical chemistry data collected under the footprint of the floating oil.
- Average daily volume of water affected by surface oil slicks was 57 billion cubic meters (15 trillion gallons).

Toxicity data for representative high and low sensitivity fish and invertebrates used to bracket range of injury in both UV and non-UV areas.

The number of organisms killed calculated using biological data from NRDA-specific field studies, historical collections, NRDA toxicity testing studies, and the published literature.
- Surface water injury > rising cone and deepwater plume based on number of larval fish and planktonic invertebrates killed.
Sargassum: designated as Essential Fish Habitat (EFH)

- Fish larvae and invertebrates, larger fish, sea turtles, sea birds rely on Sargassum as habitat, foraging area, protection from predators
- Sargassum concentrates in convergence zones -- as does surface oil
- Loss of up to 23 percent of this habitat
- Total loss of Sargassum, including foregone area from lost growth is 4,300 square miles
Larger quantities of floc were observed on the sea floor beneath areas experiencing persistent surface oil and application of dispersants.
Deepwater Benthic Exposure: Forensic Determination

- Map showing the concentration of TPAH50 attributable to DWH oil in deep-sea surface sediment (0–1 centimeter).
- PAH attributable to natural seeps are excluded following forensic analysis.
- “Footprint” of Macondo oil estimated to be ~400–700 sq. miles
Deepwater Benthic Impacts

- Deep-sea impacts to coral, red crab, benthos

Impacts to corals and fish at mesophotic Pinnacles reefs

Figure 4.5-13. Progression of injury to a coral colony at MC 294 from coverage by flocculent material in 2010, through hydroid colonization in 2011 and the onset of terminal branch loss in 2012.
DWH Oil Reaching the Nearshore Environment

Source: Kate Sweeney for NOAA.
Nearshore

- >1,300 miles of shoreline oiled using combined SCAT and NRDA data, confirmed by forensic data
- Marsh plant cover and vegetation biomass reduced along 350 to >720 miles of shoreline
- Response activities such as washing, cutting, and raking of oiled shoreline vegetation, stranding of oil booms impacted marsh animals and coastal wetland habitat

- Erosion
  - Areas of most heavy oiling and response actions had double yearly marsh edge erosion rates
  - Higher erosion rates also associated with areas that lost adjacent oyster habitat
Multiple indicator species had reductions in injury metrics

- Shrimp (growth, biomass)
- Amphipods (survival, biomass)
- Fundulus (hatch success, biomass)
- Juvenile southern flounder (growth, biomass)
- Red drum (growth, biomass)
- Fiddler crab (burrow density)
- Insects (abundance)

4 - 8.3 billion subtidal adult ‘oyster equivalents’ lost Gulf-wide from combination of oiling and river-water releases

Seagrass losses documented from oiling + response

Impacts to beaches and dunes
Figure 4.9-1. Thirteen common bottlenose dolphin stocks are found within the cumulative surface oiling footprint from the DWH oil spill, including BSE, coastal, continental shelf, and oceanic stocks. In addition, 18 other oceanic species of marine mammals are found within the oil footprint.
Tens of thousands of marine mammals exposed to DWH surface slick
- inhaled, aspirated, ingested, physically contacted, and absorbed oil

Oil damaged tissues and organs; led to adverse health effects including lung disease, reproductive failure, adrenal disease, poor body condition

Mammal exposure to DWH oil contributed to the largest and longest lasting marine mammal unusual mortality event (UME) on record in the northern Gulf of Mexico (>1,000 stranded)

Barataria dolphins one of the most severely injured populations.
- 35% increase in death
- 46% increase in failed reproduction
- 37% increase in other adverse health effects
Potential Impacts of Oil on Sea Turtles

- Oil on the shoreline can contaminate nesting females, nests, and hatchlings.
- Larger turtles can inhale oil vapors, ingest oil in prey or sediment, and become coated in oil at the surface.
- Winds and currents create ocean fronts, bringing together oil, dispersants and sargassum communities, causing prolonged floating oil exposure.
- Juvenile turtles ingest oil, inhale vapors and become fatally mired and overheated.
- Prey items may also be killed by becoming stuck in heavy oil or by dissolved oil components.
- Sargassum fouled by oil and dispersants can sink, leaving sargassum-dependent animals without food and cover and vulnerable to predators. Dead sea turtles may sink.

Source: Kate Sweeney for NOAA.
4,900-7,600 large juveniles and adults
56,000-166,000 small juveniles
35,000 hatchlings
Field studies documented number and distribution of carcasses and live birds impaired by oil.

Modeling accounted for birds not observed directly.

Toxicity studies demonstrated reproduction, anemia, immune function, heart abnormalities, other endpoints.

Plumage oiling impaired flight capability and led to behavioral changes in controlled studies.

51,000 - >84,000 birds of 93 species died, plus unrealized fledglings.